

ORIGINAL ARTICLE

Quality of life and scar evolution after negative pressure or conventional therapy for wound dehiscence following post-bariatric abdominoplasty

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Key words

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Abstract

No studies have examined scars and quality of life after different treatments of wound dehiscence in patients undergoing post-bariatric abdominoplasty. Scars and quality of life of patients with postoperative wound dehiscence managed with negative pressure wound therapy (group A) and conventional wound therapy (group B) were reviewed 6 months after wound healing. Of 38 patients undergoing treatment for wound dehiscence after 203 abdominoplasty, 35 (group A = 14 versus group B = 21) entered the study. Wound healing in group A was significantly faster than group B ($P = 0.001$). Patients ($P = 0.0001$) and observers ($P = 0.0001$) reported better overall opinions on a scar assessment scale for group A. Better overall quality of life and general health satisfaction were observed in group A ($P < 0.05$). A significant correlation was observed between the World Health Organization Quality of Life scores and Patient and Observer Scar Assessment Scale scores ($r = -0.68$, $P < 0.0001$) in all 35 patients. Negative pressure wound therapy is feasible and effective in patients with wound dehiscence following post-bariatric abdominoplasty. An adequate post-treatment outcome is achieved compared with conventional wound therapy in light of a strong association found between worse patient scar self-assessment and poor overall quality of life, regardless of the received treatment.

Introduction

Massive weight loss following bariatric surgery leaves patients with ongoing body issues, mostly related to skin excess.(1,2) The latter may have an impact on patients quality of life (QoL) with functional problems (i.e. maintaining hygiene and practicing exercises) that increase the risk of regaining previously lost weight.(3) Body contouring surgery aims to remove loose and excess skin as well as residual deposits of adipose tissue and is generally performed at least 12 months after bariatric surgery when weight loss is complete and has been stable for a minimum of 6 months.(4,5) Surgical wound complications in post-bariatric patients undergoing abdominoplasty are common and appear to be associated to previous bariatric surgery itself as well as nutrition deficiency.(6) Studies have

Key Messages

- postoperative management of wound complications after surgery may influence scars and quality of life
- the Patient and Observer Scar Assessment Scale and the World Health Organization Quality of Life-BREF questionnaire were administered to patients undergoing negative pressure or conventional wound therapy for wound dehiscence after post-bariatric abdominoplasty to assess scar and quality of life 6 months after wound healing
- faster wound healing and better overall quality of life were observed after negative pressure wound therapy compared to conventional therapy; adequate post-treatment quality of life and scar evolution is

achieved in light of a strong association found between worse patient scar self-assessment and poor overall quality of life, regardless of the received treatment

shown that post-bariatric patients have a significantly higher risk of developing complications after abdominoplasty, including wound infection and dehiscence, than non-post-bariatric patients.(7) Negative pressure wound therapy (NPWT) is a therapeutic technique using a vacuum dressing to promote healing in acute or chronic wounds and enhance healing of second- and third-degree burns.(8,9) It involves the controlled application of sub-atmospheric pressure to the local wound environment using a sealed wound dressing connected to a vacuum pump. A number of studies have been published examining NPWT, which appears to be useful for diabetic ulcers and management of the open abdomen.(10,11) No studies have specifically examined clinical outcome and QoL after different types of treatment for wound dehiscence in post-bariatric patients undergoing abdominoplasty. The purpose of this observational study was to report the comparative clinical outcome of patients undergoing NPWT with that of patients undergoing conventional wound therapy (CWT) for wound dehiscence after post-bariatric abdominoplasty in the same time period; scar and QoL evaluation as well as the relationship between post-dehiscence scars and QoL 6 months after wound healing were also analysed.

Materials and methods

This is a single-institution observational study in which eligible patients underwent negative pressure or conventional wound therapy (NPWT versus CWT) for wound dehiscence after post-bariatric abdominoplasty. The study was conducted according to the Declaration of Helsinki and approved by the local institutional review board. All patients provided written informed consent. Patients undergoing post-bariatric abdominoplasty at our surgical unit from December 2006 to December 2014 were retrospectively reviewed. Before post-bariatric abdominoplasty, all patients were advised to stop smoking, and female patients were recommended to avoid oral contraception 1 month before surgery. Vitamin deficiencies before abdominoplasty were recorded as any concentration less than the standard laboratory reference values according to definite cut-off values (vitamin A, 0.9 µmol/l; 25-hydroxyvitamin D, 37 nmol/l and vitamin E, 2.2 µmol/mmol, adjusted for serum total cholesterol and triacylglycerols). The following cut-offs for total protein (6.6 g/dl), albumin (3.5 g/dl) and ionised calcium (1.10 mmol/l) were considered. The diagnosis of wound dehiscence, defined as wound rupture occurring along the surgical incision, was required as part of the inclusion criteria. Exclusion criteria for the study were absolute contraindications to abdominoplasty, such as a history of deep vein thrombosis, bleeding diathesis and morbid obesity. Patients lost to follow-up and those who declined consent were also excluded.

NPWT and CWT

In the NPWT group, a layer of petroleum emulsion-impregnated gauze was placed directly over the entire length of the wound. The KCI (Kinetic Concepts Inc., San Antonio, TX) Vacuum Assisted Closure (V.A.C.) GranuFoam sponge was then cut and placed over the incision. An airtight seal is then achieved using the standard V.A.C. Drape. The SenSaT.R.A.C. pad (Kinetic Concepts Inc., San Antonio, Texas) is then connected in the standard fashion with the KCI V.A.C. NPWT device and set to continuous suction at negative 75 mm Hg for a total of 5 days. After 5 days of therapy, the dressing was removed and the wound inspected. The incisional NPWT (iNPWT) was then replaced, and the wound was dressed at the clinician's discretion. The decision regarding timing of redressing of the wound was made according to clinical conditions, wound appearance, amount and nature of wound discharge, patient discomfort or failure to maintain negative pressure because of a leak in the system. Therapy was discontinued either when the goal of therapy had been met in terms of restoring integrity to the abdominal wound or when further therapy was considered to be useless either because of a failure to progress clinically or because of problems related to V.A.C. In the CWT group, the wound was irrigated with 3% hydrogen peroxide, 0.5% povidone iodine and then with 1 L of normal saline. Saline dressings were applied to the wound, and the dressings were changed twice every day for the first week and then at every scheduled outpatient visit.

Definition of endpoints and outcome measures

Patients in both groups were given routine postoperative analgesia (Ketorolac 30 mg i.v. every 8 hours for 24 hours), and further analgesics were administered on request. Antibiotics were administered every 12 hours and discontinued after 3 days in all patients for 1 week after surgery. Wound dehiscence was defined as wound rupture occurring along the surgical incision. The time of onset of wound dehiscence was recorded and measured in days. The area of diagnosed dehiscence was assessed with a simple measurement of wound surface area by measuring its dimensions with a tape measure or ruler, multiplying the longitudinal maximum diameter (\varnothing) \times transverse maximum $\varnothing \times$ maximum depth, expressed in centimetres (cm³). The wound was carefully examined for bleeding occurring after the start of treatment, and the cases in which bleeding required any kind of treatment were recorded. Wound infection was defined as the presence of local symptoms of supuration with or without an isolated pathogenic microorganism from the start of treatment. The cumulative duration of days of antibiotic therapy was documented. The primary endpoint was wound-healing time, defined by the number of days the wound needed to regain complete reepithelialisation, which was recorded by one independent observer who attended the outpatients' visits (Figure 1).

Secondary endpoints

Secondary assessed outcomes included post-healing scar evaluation and QoL. The Patient and Observer Scar Assessment



Figure 1 Wound-healing process in post-bariatric patients undergoing abdominoplasty.

Scale (POSAS) was developed for the evaluation of all scar types (e.g. linear postoperative scars, burn scars).(12) The POSAS is a partial observer-administered (Observer Scale) and partial patient self-administered (Patient Scale) scale and includes scar characteristics that are clinically considered important.(13) All of the observers were general and bariatric surgeons; all of them regularly worked with obese patients. To assess the QoL, after wound healing, all patients were administered the World Health Organization Quality of Life (WHOQOL)-BREF questionnaire on selected visits during the follow-up period.(14) Patient follow-up was based on regular outpatient clinic visits, with varied time intervals between consecutive outpatient visits but which occurred at least once a week and with more strict clinical control according to the evolution of wound dehiscence. All patients were reviewed at the outpatient clinic for scar and QoL assessment at 6 months after wound healing.

Statistical analysis

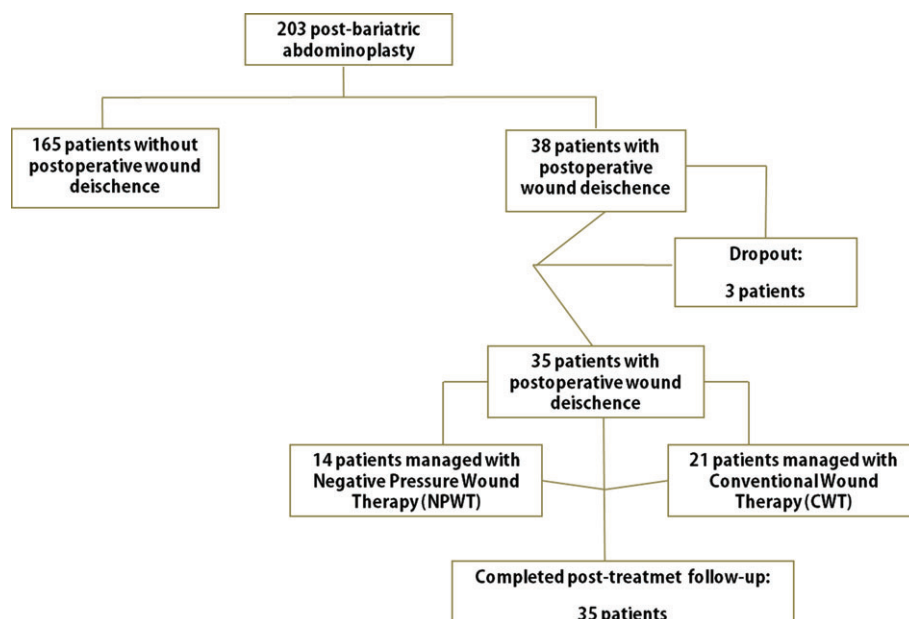
Continuous data are expressed as either median (range) or mean \pm SD (range) as appropriate. Differences in means and medians between sub-groups were compared using Mann–Whitney *U*-tests. Categorical variables were analysed using Fisher's exact test. The Pearson correlation with a two-tailed test of significance was used to establish the relationship between the scores at the WHOQOL-BREF questionnaire and the scores recorded for the POSAS scale. For our purposes, in this analysis, we used only the total score of WHOQOL-BREF and POSAS patient scale in the entire study population. The significance criterion was set at 0.05. Pearson's product moment correlation coefficient is a measure of the strength of the supposed linear association between the two sets of values. *P* values 0.05 were considered statistically significant.

Results

A total of 203 post-bariatric abdominoplasty were performed in our department. Of the 203 patients, 38 patients (18.7%) developing postoperative wound dehiscence were managed by NPWT or CWT; 35/38 patients completing post-treatment follow-up entered the study, whilst three patients were lost to follow-up; two missed the outpatient clinic, and one moved to another address (Figure 2).

Peri-treatment evaluation

A total of 23 patients were female (male/female ratio 1:3), and the median age at the time of the study was 33 (24–59) years. None of all 35 patients had evidence of fascial dehiscence. Among the 35 patients with a wound dehiscence, 14 (40%) had NPWT, and 21 had CWT. No statistically significant differences were found in terms of age, gender, body mass index (BMI) and percentage of excess weight loss (E%WL) between the two groups of patients. Patients' characteristics are summarised in Table 1. The two groups of patients did not differ in terms of pre-treatment comorbidities, with a statistically comparable number of smokers, diabetics and cardiopathic patients ($P = \text{NS}$). At baseline, median serum concentrations of albumin (3.8 versus 3.8) and total proteins (6.8 versus 6.9) did not differ between patients undergoing NPWT and CWT ($P = \text{NS}$). Furthermore, median values of vitamin A (1.8 versus 1.9), vitamin E (4.2 versus 4.2), 25-hydroxyvitamin D (52 versus 52) and ionised calcium (1.2 versus 1.3) were comparable between the two treatment groups (NPWT versus CWT; $P = \text{NS}$). The area of wound dehiscence was comparable between the two groups ($P = \text{NS}$) (Table 1); no statistically significant differences were found in time of onset of wound dehiscence (TOWD) between the two groups with a median TOWD of 8 days in both (NPT versus CWT; $P = \text{NS}$). No differences in the rate of wound bleeding and infection were recorded between the two groups

**Figure 2** Patient flow during the study.**Table 1** Characteristics of patients undergoing negative pressure wound therapy (NPWT) and conventional wound therapy (CWT)*

Characteristics	NPWT (n = 14)	CWT (n = 21)	P value
Age	35 ± 8.7	34.4 ± 7.7	0.74†
Gender (male)	4	8	0.72‡
BMI before abdominoplasty (kg/m ²)	33.5 ± 3.2	34.2 ± 6.8	0.66†
E%WL	35.2 ± 5.1	36.2 ± 7.3	0.70†
Smokers	7	9	0.73
Diabetics	2	4	1‡
Cardiac disease	3	4	1‡
MAWD (cm ²)	1231.4 ± 319.2	1034.4 ± 69.2	0.17†
TOWD (days)	8.4 ± 1.6	8.8 ± 1.5	0.44†

BMI, body mass index; E%WL, percentage of excess weight loss; AWD, area of wound dehiscence; TOWD, time of onset of wound dehiscence.

*Data are expressed as mean ± SD or as numbers.

†Mann–Whitney *U*-test.

‡Fisher exact test.

of patients (Table 2). The median cumulative duration of antibiotic therapy was significantly shorter in the NPWT than CWT group (15 versus 28, $P = 0.0001$). The rate of hospital readmission was statistically comparable between the two groups (14% versus 0%). Wound healing in the NPWT group occurred significantly faster than the CWT group ($P = 0.0001$).

Post-treatment evaluation

At 6 months follow-up, 35 patients were administered the POSAS Scale and the WHOQOL questionnaire. The patients' scar assessment scale showed better results in the NPWT patients. Those patients managed with CWT demonstrated worse scores of pain ($P = 0.014$), stiffness ($P = 0.018$), thickness ($P = 0.005$) and irregularity ($P = 0.0001$). Patients who underwent NPWT reported a significantly better overall opinion regarding their own scars compared to those who underwent CWT

Table 2 Outcome of patients undergoing negative pressure wound therapy (NPWT) and conventional wound therapy (CWT)*

Parameters	NPWT (n = 14)	CWT (n = 21)	P value
Wound bleeding	0	2	0.50‡
Wound infection	1	4	0.62‡
Cumulative duration of antibiotic therapy	14.3 ± 1.5	27.3 ± 6.7	0.0001†
Readmission	2	0	0.15‡
Wound-healing time (days)	97.1 ± 32.1	182.9 ± 46.1	0.0001†

*Data are expressed as mean ± SD or as numbers.

†Mann–Whitney *U*-test.

‡Fisher exact test.

(Table 3). The observer scar assessment scale demonstrated better results in the NPWT patients. In patients managed by CWT, worse scores of pigmentation ($P = 0.0001$), pliability ($P = 0.01$) and surface area of the scar ($P = 0.005$) were recorded. In patients who underwent NPWT, observers reported a significantly better overall opinion compared to CWT ($P = 0.0001$). Table 4 shows the WHOQOL-BREF scale scores 6 months after the end of treatment for patients who underwent NPWT and CWT. At follow-up evaluation, better overall QoL and general health satisfaction were observed in patients managed with NPWT. Among the four domains of the questionnaire, physical health and social relationship were specifically significantly worse in the CWT ($P < 0.05$). The two groups of patients had comparable baseline scores in all QoL domains just before abdominoplasty ($P = \text{NS}$). Figure 3 shows the relationship between the scores for overall QoL, recorded at the WHOQOL-BREF questionnaire and the values for the patient scores at the POSAS scale, using Pearson's correlation coefficient for the entire population of 35 patients. A significant correlation was observed between the WHOQOL-BREF scores and POSAS scale scores ($r = -0.68$, $P < 0.0001$). This negative value denotes a strong

Table 3 Post-treatment evaluation with patient and observer scar assessment scales (POSAS) of patients undergoing negative pressure wound therapy (NPWT) and conventional wound therapy (CWT)*

POSAS scales	NPWT (n = 14)	CWT (n = 21)	P value
PATIENT			
Pain	2.0 ± 0.7	2.8 ± 0.9	0.014
Itching	2.9 ± 0.7	3.0 ± 0.5	0.75
Colour	3.6 ± 1.0	3.3 ± 0.6	0.37
Stiffness	2.2 ± 0.8	3.0 ± 1.0	0.018
Thickness	2.4 ± 0.5	3.2 ± 1.0	0.005
Irregularity	5.6 ± 1.1	7.6 ± 0.8	0.0001
Overall Opinion	2.9 ± 0.7	5.3 ± 0.9	0.0001
OBSERVER			
Vascularity	1.2 ± 0.4	1.3 ± 0.6	0.98
Pigmentation	1.3 ± 0.6	2.8 ± 0.8	0.0001
Thickness	2.0 ± 0.5	2.2 ± 0.6	0.23
Relief	2.6 ± 0.8	2.2 ± 0.5	0.10
Pliability	1.2 ± 0.6	2.1 ± 0.5	0.01
Surface area	2.8 ± 0.5	4.0 ± 0.7	0.0001
Overall opinion	2.5 ± 0.6	3.7 ± 0.7	0.0001

*Data are expressed as mean ± SD.

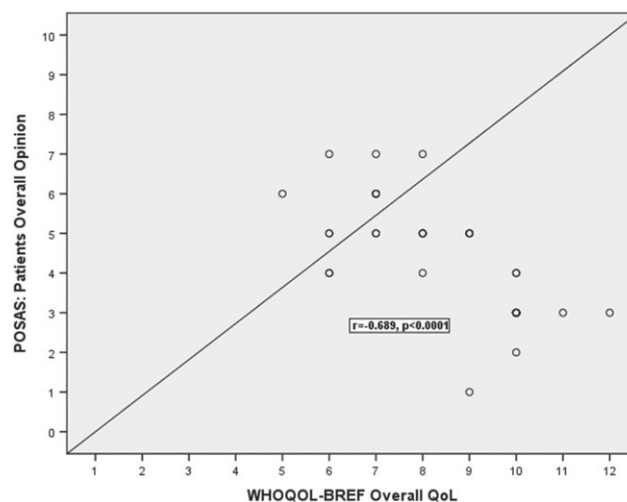
Table 4 Post-treatment evaluation with WHOQOL-BREF questionnaire of patients undergoing negative pressure wound therapy (NPWT) and conventional wound therapy (CWT)

Domains	NPWT (n = 14)	CWT (n = 21)	P value
Overall QoL	10.0 ± 0.9	7.3 ± 1.2	0.0001
General health satisfaction	10.2 ± 0.8	7.3 ± 1.1	0.0001
Physical health	10.0 ± 0.9	7.2 ± 1.1	0.0001
Psychological health	13.0 ± 1.4	12.5 ± 1.0	0.21
Social relationships	12.7 ± 1.5	11.4 ± 0.9	0.009
Environment	13.5 ± 1.3	12.9 ± 1.1	0.11

negative association between the two scales because as the value of the WHOQOL-BREF score increases, the value of the POSAS score decreases.

Discussion

Patients undergoing body-countering surgery after massive weight loss following bariatric procedures are likely to carry a higher risk of postoperative wound complications.(7) Post-bariatric patients often present with nutritional deficiencies, particularly in the first postoperative year, which are able to negatively influence the wound-healing process.(15–18) A recent study reported that pre-treatment protein supplementation was a simple intervention that could significantly decrease wound-healing complications after abdominoplasty in post-bariatric patients with massive weight loss.(19) In this study, 18% (n = 38) of the entire population of 203 patients admitted in our unit for scheduled post-bariatric abdominoplasty over a 9-year period had a diagnosis of postoperative wound dehiscence. Among 35 patients completing the study, those undergoing NPWT for postoperative wound dehiscence had better overall results compared to those treated by CWT, with a favourable wound-healing process. Several risk factors have been previously reported in association with an increased

**Figure 3** Correlation between the WHOQOL-BREF questionnaire and the POSAS scale in all 35 patients at 6 months after wound healing.

rate of complications after plastic surgery, including smoking, obesity, hypertension and previous abdominal surgery.(20) Although we did not compare postoperative wound dehiscence for NPWT and CWT after stratification based on features known to be related to postoperative wound dehiscence, all baseline characteristics, such as age, gender, preoperative BMI, percentage of excess weight loss, smoking habits and other comorbidities, were not significantly different between the two treatment groups. In this study, the nutritional patterns during the two treatment follow-ups was not specifically analysed, but the nutritional status assessed by laboratory examinations before abdominoplasty was not different between the two groups. The therapeutic management of wound dehiscence usually requires dressing changes and antibiotic coverage with eventual fascial and cutaneous closure to enhance healing by secondary intention.(21) Negative pressure wound therapy has been previously reported to be particularly useful in trauma patients, where a vacuum-assisted closure (VAC) system may offer decreased bowel oedema and wound size, reduced bacterial colonisation, enhanced neovascularisation and increased granulation tissue formation.(9,21) In this study, the employment of NPWT in every patient lasted, on average, for a long period of time with the aim of exploiting its specific reported characteristics (i.e., absorbing interstitial fluid, improving microvascular and lymphatic drainage, increasing oxygenation and nutrition and removing catabolites).(22,23) We observed that patients receiving NPWT had better outcomes compared to those managed by CWT, with shorter cumulative durations of antibiotic therapy and, above all, faster wound-healing times. Indeed, the time of onset of postoperative wound dehiscence was similar for NPWT and CWT groups, and both the treatment groups also had comparable results concerning the median area of wound dehiscence recorded at the time of diagnosis. Bariatric surgery includes several weight-loss procedures associated with variable improvement in psychological well-being and QoL.(24–27) Post-bariatric abdominoplasty is a plastic surgical intervention addressing abdominal skin laxity as a cutaneous deformity able to determine physical

and psychological impairment.(28–31) Postoperative keloid and hypertrophic scars have been shown to determine significant cosmetic problems, leading to functional impairment and psychosocial difficulties as much as in patients with dermatological diseases.(32) In this study, patients undergoing NPWT for postoperative wound dehiscence had better scar evaluation on the POSAS. In particular, at 6 months follow-up after wound healing, both patients and observers in the NPWT group reported significantly better overall opinions at scar assessment compared to those managed by CWT. Furthermore, overall QoL and general health satisfaction assessed by the WHOQOL-BREF questionnaire showed better results for patients managed with NPWT. Before abdominoplasty, both groups of patients had comparable baseline scores in all QoL domains. Previously published studies have analysed the relationship between postoperative scars and QoL; Choi and coworkers showed that neither the patterns of thyroid scars nor patients' own characteristics had any impact on QoL after surgery for thyroid cancer.(33) Interestingly, QoL did not appear to be associated with severity or type of the scar but rather with the presence of the scar itself as also demonstrated by others in patients with keloids and hypertrophic scars. In contrast with these findings, Bock *et al.* found that QoL in patients with visible scars is poorer than in those with invisible lesions, probably explaining why a visible scar, such as that after thyroidectomy, is associated with a severe deterioration in QoL.(34) Although in this study, we did not specifically search for any possible independent factors affecting QoL of patients treated with NPWT or CWT for wound dehiscence after abdominoplasty, a strong relationship between QoL and scar assessment respectively employing the WHOQOL-BREF questionnaire and the POSAS scale was also identified at the follow-up evaluation in the entire study population. In detail, the negative association between the values recorded with these two tools was clearly evident because as the score for patients' individual perception of QoL in general increased, the overall opinion of patients' scar assessment decreased. Thus, the better self-perception and acceptance of post-treatment scars was, the better was patients' overall QoL. In a recent paper, similar results have been published regarding a strong relationship between burn scars and QoL in the survivors of major burns who received allotransplant.(35) Body counteracting after surgical weight loss has been shown to improve both QoL and body image and to produce dissatisfaction with other parts of the body, suggesting that as patients move closer to their ideal, these ideals may shift.(36) In light of this, our findings confirmed to some extent the results of this previous study, indicating that even postoperative sequelae of body-counteracting surgery may negatively influence patients' QoL. Nonetheless, to clarify whether postoperative long-term sequelae of body-counteracting surgery or any changes over time in patients' body ideal had a major influence on QoL was not the aim of the current study. This prospective observational study has documented feasibility and efficacy of NPWT in patients with post-abdominoplasty wound dehiscence, with advantages in terms of required antibiotic therapy and wound-healing time compared to CWT. Post-healing scar assessment and QoL showed better results in patients managed with NPWT. These findings are limited by the non-randomised design of the study based on the relatively

low incidence of postoperative wound dehiscence and selection bias related to the choice of approach based merely on physician's clinical judgment. At last, worse patient self-perception and acceptance of post-treatment scars was associated with poor overall QoL, regardless of the received treatment. The findings of this pilot observational study, based on a small number of patients who experienced wound dehiscence as an infrequent complication of post-bariatric abdominoplasty, should be confirmed by a carefully designed and adequately powered prospective randomised trial.

Acknowledgement

The study was conducted according to the Declaration of Helsinki; the protocol was reviewed and approved by the institutional review board, and all patients provided written informed consent. The authors have no financial disclosures.

Author contribution

PL and GC contributed to the conception, design and drafting of the article; SL, GG and LB contributed to acquisition, analysis and interpretation of data; GD and LD revised it critically and gave final approval of the version to be published.

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